Making the most of UK/China research and innovation partnership
The Arup Perspective

Michael Kwok
11 June 2014

ARUP

More than 11,000 staff based in over 90 offices across more than 35 countries
Sydney Opera House, Australia

National Stadium and National Swimming Centre, China
Why

• Innovation supported by research is a vital factor in business success

• Research at Arup is a tool for creating financial and knowledge value by building capability and evidence; these enhance business advantage

• Value from research comes in a variety of forms as well as revenue growth, and often over an extended period
- Arup as a knowledge enterprise, globally
- Arup as a knowledge enterprise, in China

- The scale of innovation
- A hunger for innovation
- The demand for innovation
- The speed of innovation
- The drive for innovation
- The people for innovation

Shanghai Pudong in 1990
Shanghai Pudong in 1990 and 20 years later……

First in China
Reaching new height

Economic miracle
China has overtaken US as largest construction market

![Pie chart showing construction market share by country.]

Chinese Cities: Scale and Speed of Urbanization

![Images showing urbanization progress from 1978 to 2012.]

1978: 17.9%
1990: 26%
2012: 52.6%

Developed countries average = 70%
Urbanization and per capita income growth go hand in hand

The demand for innovation

**China’s Carbon Targets**

Reduce Carbon Intensity by 40-45% by 2020 - compared to 2005 levels (State Council, 2009 – First time having specific carbon emissions target).

12th 5 Year Plan - **Reduce Carbon Intensity by 17%** by end 2015

Carbon/energy saving measures & targets for 10,000 businesses in energy intensive industries.

Forest Coverage target of **> 21.66%**
**Renewable Energy**
- Wind Power – 200GW by 2020
- Solar – 50 GW by 2020
- Biomass – 15 GW by 2015

**Automotive**
- Fuel Efficiency – China V by 2016
- Electric Vehicles – Target 5m by 2020
- Subsidies for smaller engines, fuel efficiency and hybrid/ EV

**Green Building Movement Plan**
- Developers Incentives – 1% GFA increase for each star in the 3-star green building rating system.
- Subsidies for communities with at least 30% green buildings.

**Construction of Smart Grid**
- UHV lines & networks, remote monitoring and EV charging

**Other Clean Tech Initiatives**

**A demand for innovation**

**Urban Metro**

<table>
<thead>
<tr>
<th>Year</th>
<th>Lines</th>
<th>Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2013</td>
<td>55</td>
<td>17</td>
</tr>
<tr>
<td>2015</td>
<td>87</td>
<td>25</td>
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The **speed** of innovation
The speed of innovation

Beijing Changxindian Eco-City
Conceptual and detailed regulatory planning

The first approved detailed regulatory plan in China, which was integrated with ecological indicator.

The comprehensive resource Management Method provided the Energy Consumption, Hydrologic Cycle and waste with integrated solutions.

Integrate the breeze corridor into the urban design layout to ameliorate the micro-climate environment.

The speed of innovation

Setting targets

50% reduction in CO2 emission compared to BAU

Domestic water use to be less than 110 litres p/d

Reduce domestic waste generation to 0.8kg p/day

100% of residents within 400m of public transport stops

At least 15% of energy supply from renewable energy

At least 15% of residential development for social housing

2010
Innovative Zoning Plan

500 hectares site south-west of Beijing city
Innovative approach to incorporate low carbon & sustainable planning conditions into statutory zoning plans.
First of its kind in the China urban planning system.

Beijing Changxindian Eco-City
Implementation
The **speed** of innovation

**Beijing Changxindian Eco-City**

Implementation

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**How**

- Research Roadmap
- Joint research
- Project collaborations
- Knowledge sharing

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Research philosophy

Engineering problems, technical challenges etc.

Stay ahead of the game, being at cutting edge, pursuing excellence etc.

East Asia Research Roadmap: 2013

Developing 2009 Roadmap to 2013 Roadmap

Research elements are classified into six new categories in this 2013 Roadmap. Previous 2009 Roadmap categories are represented by following icons and are shown for each research element in this booklet.

City Infrastructure  Urban Resilience  Energy & Resources  Evolving Technologies  Intelligent & Efficient Systems  Social & Economic Impacts
Research roadmapping
Drivers, Business Opportunities, and Research Elements

Research strategy

Short/long-term Drivers

Arup will provide full funding

Research topics with highest priorities

Research topics with fairly high priorities and shared interests from other parties

Research topics with priorities and shared interests from other

Arup will provide matching funding

Arup will provide support and jointly apply other funding

Funding allocation with priorities

12/06/2014
Research partners: maximizing co-benefits

A successful example

- Research title: Damped outrigger concept for tall buildings
- Research aim: verify the compliance of Arup damped outrigger concept to the Chinese standards through laboratory test
- Research partner: Guangzhou University, China

Why succeeded?

- Approaching the right partner and solving challenges well;
- Very well applications of research results (e.g. direct application in Arup projects), and helping Arup keep leading position in this field;
**Project Collaborations**

- Collaboration with external partners
- Multi-disciplinary skills

**Collaboration Parties**

- Arup
- PTW Architects
- China State Construction Engineering Corporation (CSCEC)
- China State Construction International Shenzhen Design Consulting Co

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**Case Example – Water Cube**

![Concept & Design](image1)

![Structure](image2)

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**Project Collaborations**

- Collaboration with external partners
- Multi-disciplinary skills

**Case Example – Water Cube**

![Sustainability](image3)

![Fire Engineering](image4)

![Construction Management](image5)
Technical forums: knowledge sharing

Tongji U - Nov. 2011

HKUST - March 2012

South China University of Technology - Sept. 2012

Shenzhen U - Dec. 2013

Student visit (South China University of Technology) : knowledge dissemination

In Arup HK

Tolo Highway

HK-Macao-Zhuhai Bridge

HATs-2a
What

• MoU
• Strategic Partners
• Joint research
• Challenges

Strategic partners: exploring broadly

Memorandum of Understanding concerning International Collaboration on Sustainability Research, including Institutes for Sustainability in London and Shanghai

Signatories: Thames Gateway Institute for Sustainability, Tongji University and Arup

Memorandum of Understanding between Arup and University of Nottingham at Ningbo, China concerning Collaboration on Engineering Research and Professional Development

Signatories: University of Nottingham at Ningbo and Arup

March 2013

关于共同申请国际和国家基金开展能源和环境领域科技创新活动的合作备忘录

April 2013

签署方:
河南省科技厅对外交流合作中心，郑州市花园路 27 号
英国奥雅纳（香港）公司，中国香港，九龙塘，达之路 80 号，
又一城 5 楼
Strategic partners: exploring broadly

Joint research applications towards external funding: keep mind open under funding bodies in China and International Collaboration Programmes

Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

- **Research partner**: Dr Xin Yuan and Prof. Xuefei Shi, Tongji U
- **Research title**: designing bridge energy self-sufficiency system
- **Funding budget**: 200,000 RMB
- **Funding body**: Guang Hua Foundation, Tongji U, Shanghai
- **Brief**: considering various energy demands during bridge operation and different types of renewable energy, developing bridge energy self-sufficiency system and making life cycle analysis
Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

- **Research partner**: Prof Ruiqin Zhang, University of Zhengzhou, Henan
- **Research title**: High tech Henan - Winning carbon savings and air pollution from upgraded industrial policy and practice in the 13th Five Year Plan
- **Funding budget**: 1,200,000 RMB in total
- **Funding body**: half provided by UK’s Strategic Programme Fund (SPF) Programme for China Prosperity; another half by Henan Development and Reform Commission (DRC);
- **Brief**: Clearly identify the goal of Henan Province’s industrial restructuring for the year 2020, with a comprehensive and effective proposal for the de-carbonisation, clean air and industrial restructuring strategy for the province.

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Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

- **Research partner**: Prof Shifu Wang, South China University of Technology, Guang Dong
- **Research title**: exploring business framework for smart city in future
- **Funding budget**: 80,000 RMB (to be confirmed)
- **Funding body**: Open call – National Building Key Lab 2015;
- **Brief**: reviewing current business framework of smart city, discuss different industries matching with different types of framework, connecting the practices of Smart Guangzhou and proposing future business framework with challenges and timeline.
Strategic partners: examples of exploring broadly

Joint research applications towards external funding: global collaboration

- **Research partner**: London School of Hygiene & Tropical Medicine, UCL, Peking University etc.

- **Research title**: PURGE

- **Funding budget**: around 35 million RMB

- **Funding body**: Seventh Framework Programme (FP7), EU

- **Brief**: the PURGE project aims to add further evidence in this area by developing methods to quantify the positive and negative impacts on health and wellbeing of GHG reduction strategies in urban areas of Europe, China and India, so as to inform policy decisions in such areas as energy, housing/built environment, transport, and food.

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**China’s R&D Funding Structure**

<table>
<thead>
<tr>
<th>Government-led Research Activities</th>
<th>Non-Government-led Research Activities</th>
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<tbody>
<tr>
<td><strong>Sponsors:</strong></td>
<td><strong>Sponsors:</strong></td>
</tr>
<tr>
<td>Government</td>
<td>Non-government foundations</td>
</tr>
<tr>
<td>Professional associations</td>
<td>Non-profit organizations</td>
</tr>
<tr>
<td>Research Institutes</td>
<td>Corporations</td>
</tr>
<tr>
<td>Inefficient productivity transformation from research outcomes</td>
<td>Efficient productivity transformation from research outcomes</td>
</tr>
<tr>
<td>Strong influence on policy and industry development</td>
<td>Weak influence on policy and industry development</td>
</tr>
<tr>
<td>International cooperation through intergovernmental agreement</td>
<td>International cooperation through private activities</td>
</tr>
</tbody>
</table>

Action
Not Always Successful
An invisible barrier to enter Chinese government-led research activity

Best-case Scenario